Acute limb ischemia secondary to myositis-induced compartment syndrome in a patient with human immunodeficiency virus infection

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Myositis, while uncommon, develops more frequently in patients with human immunodeficiency virus infection. We report a case of acute lower leg ischemia caused by myositis in such a patient. Urgent four-compartment fasciotomy of the lower leg was performed, which decompressed the compartmental hypertension and reversed the arterial ischemia. This case underscores the importance of recognizing compartment syndrome as a cause of acute limb ischemia. (J Vasc Surg 2003;37:1103-5.)

Compartment syndrome results from elevated pressure within an enclosed fascial space, which can occur after fracture, soft tissue injury, or reperfusion after arterial ischemia.[1] Other less common causes of compartment syndrome include prolonged limb compression, burns, and extreme exertion.[1] Soft tissue infection in the form of myositis is a rare cause of compartment syndrome. We report an unusual case of myositis-induced lower leg compartment syndrome in a patient with human immunodeficiency virus (HIV) infection. This uncommon cause of acute arterial ischemia in patients with compromised immune systems is discussed. Clinicians must be alert to compartment syndrome as a cause of acute limb ischemia in the absence of usual predisposing factors.

CASE REPORT

A 48-year-old man with HIV infection was seen in the emergency room with lethargy and general weakness. He had been taking antiretroviral therapy, ie, zidovudine and azidothymidine, for HIV infection. While in the emergency room the patient exhibited altered mental status and became increasingly withdrawn. Laboratory studies showed HIV helper cell count (CD4) of 93 cells/mm^3, white blood cell count of 11,000 cells/mm^3, and serum creatinine concentration of 1.8 mg/dL. Within 24 hours of hospital admission the patient became febrile, with temperature of 102.4°F, and acute right lower leg ischemia developed. Physical examination revealed a cold and swollen right lower leg with multiple bullae over the calf region. Motor and sensory function were normal, without passive stretch signs. Although femoral and popliteal pulses were palpable, pedal artery flow signals could not be detected with Doppler scanning of the right leg. The right calf compartment was firm and tender. Additional pertinent laboratory studies revealed creatine phosphokinase level of 53,350 U/L; serum creatinine concentration had increased to 3.5 mg/dL, and WBC count had increased to 18,000 cells/mm^3. Venous duplex scans showed no evidence of deep venous thrombosis in the right lower leg. Pressure was measured in all four compartments of the right calf and ranged from 55 to 65 mm Hg. Because of significant compartmental hypertension, urgent four-compartment fasciotomy was performed through bilateral incisions. The fascia was intact and without any evidence of infection. On opening the fascia, the underlying muscles, which appeared tense and edematous, immediately bulged under pressure (Fig 1). Muscle biopsy tissue revealed focal perivascular inflammation, interstitial edema, and mononuclear cell infiltration with HIV suppressor cells (CD8+), CD4+, B lymphocytes, and macrophages (Fig 2). These findings are consistent with immune-mediated myositis. Because intraoperative Doppler scanning failed to demonstrate any pedal artery signals after the fasciotomies, intraoperative angiography was performed with percutaneous antegrade cannulation of the right common femoral artery, which revealed a long segment of arterial spasm in the tibial and peroneal arteries. Intra-arterial papaverine hydrochloride (30 mg) was administered in the right common femoral artery, which resulted in distal pedal Doppler signals.

On postoperative day 1 the right dorsalis pedis and posterior tibial pulses became palpable. In addition, the right foot had regained normal color and warmth. Muscle tissue and blood cultures were all negative for infection. Systemic corticosteroid therapy was started, and the patient's condition has since improved. Serum creatinine and creatine phosphokinase concentrations returned to normal during the postoperative period. Split-thickness skin grafting was performed to cover the fasciotomy sites on postoperative day 12, and the patient was discharged on postoperative day 22.

DISCUSSION

This unusual case of compartment syndrome caused by HIV-related myositis, which resulted in acute lower leg ischemia, is unique for both cause of myositis and severity of the resultant compartment syndrome.

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Fig 1. Substantial muscle swelling remained visible after four-compartment fasciotomy in patient with myositis-induced compartment syndrome.

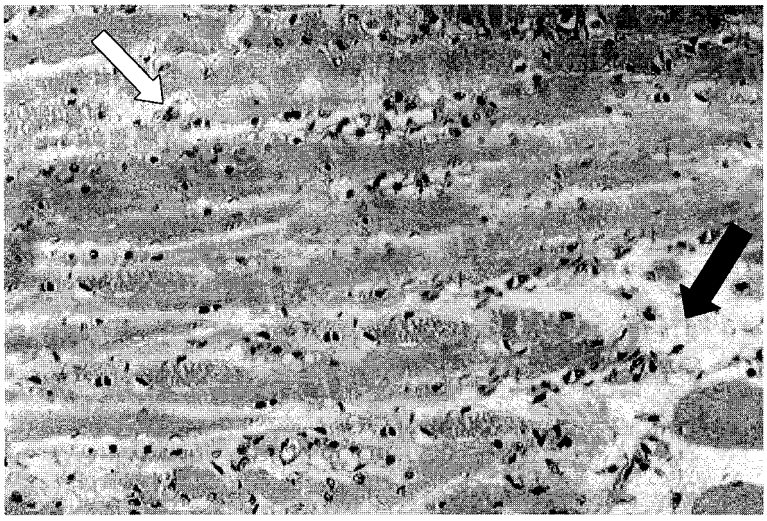

Fig 2. Calf muscle biopsy specimen demonstrated acute myositis, evidenced by focal interstitial inflammatory infiltrates *(white arrow)*, thickened basement membrane, and interstitial edema *(black arrow)*.

Although myositis is rare, it can be caused by viral infection, bacterial infection, or immune mediated process. HIV-associated myositis was first described in 1983,[2] and numerous reports have linked myositis and HIV infection.[3-5] Myositis can have various clinical manifestations in immunocompromised hosts. Pyomyositis, mainly seen in the tropics and usually caused by gram-positive bacteria such as *Staphylococcus* and *Streptococcus* organisms, is now seen more frequently in association with HIV infection.[3,4,6] Other etiologic agents including gram-negative organism such as *Mycobacterium avium* have also been reported.[4] In dermatomyositis, also with higher prevalence in HIV-infected populations, affected skin and muscle exhibit various degrees of cell necrosis, vacuolization, and fibrosis, as well as mononuclear cell infiltration with CD8+ T cells, although CD4+ cells, B lymphocytes, and macrophages are also present.[5]

Immune-mediated myositis, as in our patient, has also been associated with HIV infection. Clinical findings usually include severe muscle swelling in the affected limb. Physical examination may reveal tender calf muscle, with erythema and bullae in overlying skin, as in our patient. Muscle biopsy specimens may demonstrate perivascular inflammation, necrosis, interstitial edema, and mononuclear cell infiltration with CD8+, CD4+, B lymphocytes, and macrophages.[7] Severe muscle swelling may cause com-

partmental hypertension and compromise arterial circulation. To our knowledge, this is the first reported case of acute limb ischemia caused by myositis-induced compartment syndrome. Elevated creatinine phosphokinase concentration and transient renal insufficiency, as in our patient, reflect substantial muscle injury. With prolonged muscle damage, additional abnormal laboratory findings in myositis may include hyperkalemia, hypocalcemia, and hyperuricemia.[8]

A suspected diagnosis of compartment syndrome can be substantiated with compartmental pressure greater than 35 mm Hg. Compartment syndrome can result in muscle and nerve damage because of increased tissue pressure. As tissue pressure approaches terminal arteriolar pressure, nutrients in the arteriolar system cannot reach the capillary bed, which can result in tissue ischemia.[9] Blood flow in the capillary circulation ceases when compartmental pressure is greater than 35 mm Hg.[10,11] The sensory nerves that transmit touch and pain sensation, or the C fibers, are affected first, followed by the motor nerves. Muscle and fat are affected next. The skin is most resistant to ischemia[10] and hence may seem viable even when there is nonviable muscle underneath.

During the initial period of compartmental hypertension, the surrounding microcirculation can compensate for decreased blood flow with autoregulation of the arterial system and increased venous oxygen extraction.[12] However, as compartmental hypertension continues, compensatory autoregulation will fail, resulting in acute ischemia. A high index of suspicion is essential to diagnose compartmental hypertension, because irreversible neurologic injury can occur if the pressure is not relieved within 4 to 6 hours. Prompt decompression of the affected compartments with effective fasciotomy and antibiotic therapy if there is an infective cause are essential and usually result in recovery.

Patients with HIV-induced myopathy can have lower leg muscle weakness as a result of long-term antiretroviral zidovudine therapy.[13] Muscle biopsy specimens demonstrate multifocal necrotizing myopathy with little or no inflammation. Histologic staining shows ragged red fibers, indicative of abnormal mitochondria.[13] In addition, tubuloreticular inclusions may be noted in the capillary endothelial cells, suggestive of azidothymidine toxicity.[14] The clinical manifestations rapidly respond to drug withdrawal. Although our patient has been receiving long-term antiretroviral therapy, clinical and histologic findings were suggestive of myositis rather than myopathy. Therefore, medication was continued, with clinical improvement.

In conclusion, this case report illustrates the presentation and management of arterial ischemia caused by myositis-induced compartment syndrome in an HIV-infected patient. Diagnosis of compartment syndrome was substantiated by elevated compartment pressure. Four-compartment fasciotomy was effective in alleviating compartment syndrome and restoring arterial circulation. This report underscores consideration of myositis-induced compartment syndrome as a cause of acute limb ischemia in patients with immune system compromise.

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